A FISH HABITATION.

BY WM. P. SEAL.

The common toad fish, *Batrachus tan*, owing to its extreme hardiness, wide distribution, and the ease with which it is kept in salt water aquaria, is perhaps the best known of our more curious marine fishes.

They are generally considered to be ugly and repulsive in appearance. Studied as examples of harmony in design and color, they might be called beautiful. As a compromise of the two ideas, they might appropriately be called beautifully ugly.

They are not generally much valued as food, although in some parts of Chesapeake Bay the fishermen esteem them very highly, the meat being firm, white, and delicate. They may, therefore, some day occupy a high place in the esteem of the epicure.

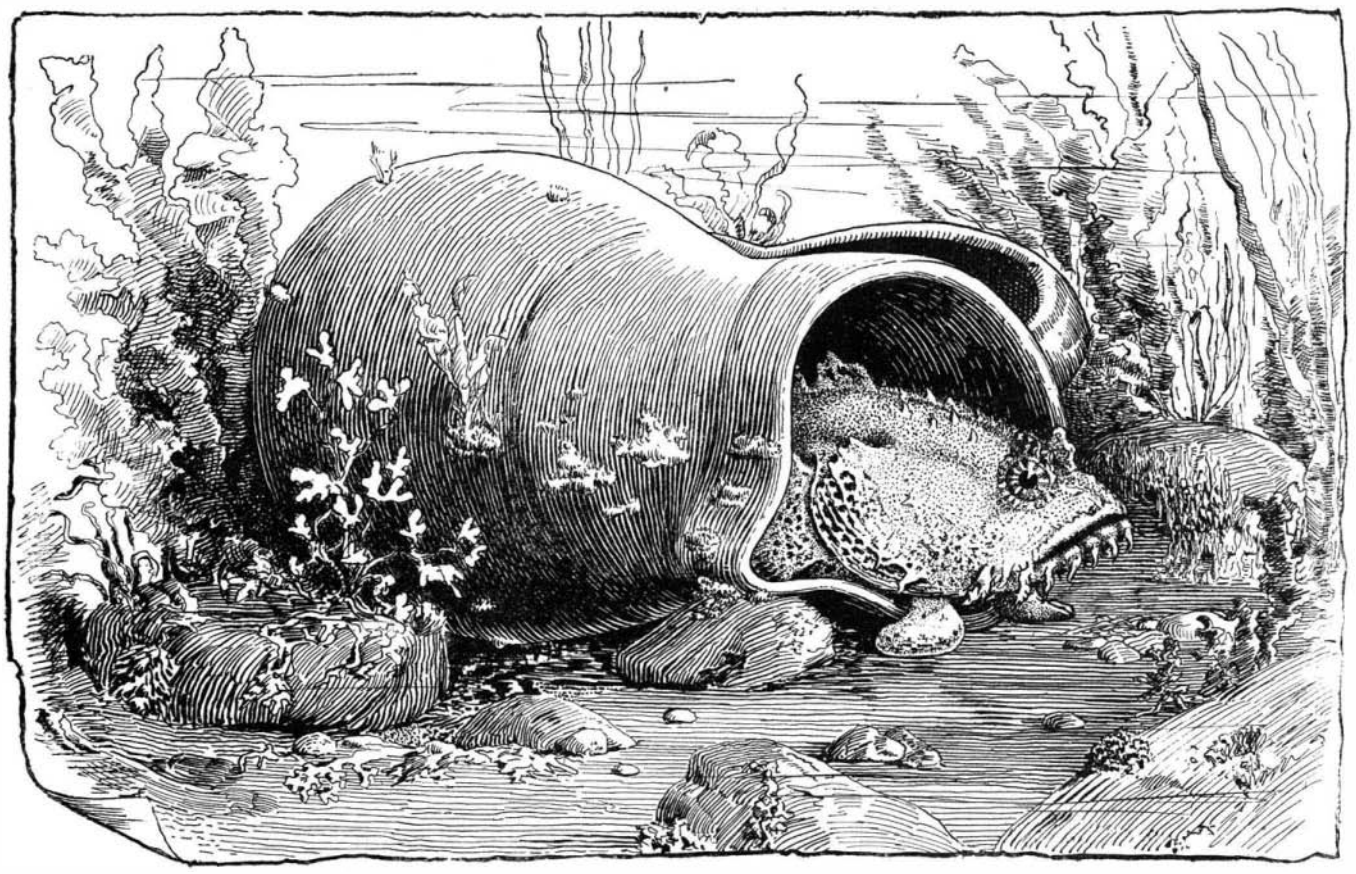
They usually deposit their eggs (in a single layer) on the under side of stones or in crevices of the rocks, the male guarding the eggs, and also the young, which remain attached where deposited for a considerable period after they are hatched.

The accompanying illustration represents a habitation selected by a toad fish. It is one of two (the other a jug with neck broken off) which were taken from Great Harbor, at Wood's Holl, Mass., and sent to the aquaria of the United States Fish Commission at Washington, D. C., where they are now exhibited.

When found each of the vessels had the eggs of a toad fish adhering to the upper inside surface and was occupied by the male fish, which guards the eggs and young until they are ready to take up the thread of life on their own account. The toad fish is often found ensconced in pieces of drain tile and even old shoes and boots or other hollow receptacles affording it the necessary protection. The writer found a small one in Chesapeake Bay enjoying possession of a beer bottle having the bottom knocked out. The outside of the bottle was beautifully ornamented with a luxuriant set of oyster spat.

In the aquarium at Washington there are frequent battles for possession of the pitcher and jug, but the ones having occupancy at the time are always able to hold them against aggressors, demonstrating that possession is a great advantage outside the jurisdiction of courts.

The selection of habitations by some species and the actual building of quite elaborate ones by others seems to indicate an æsthetic sense as well as a comprehension of the problems of life, not so much different, perhaps, from those of prehistoric man or of the lowest existing races. Much observation of what are called the lower forms of life is apt to impress one with the idea that their perceptive faculties are more acute than our own concerning the actual necessities of existence, that the emotions or feelings which actuate them are not dissimilar from those we experience, and that their judgment is possibly quite as nearly infallible as our own.



A FISH HABITATION—BATRACHUS TAN.

Oxalic Acid from Waste Sulphite Liquor.

Waste liquors produced in manufacturing wood fiber by the sulphite process are filtered either through felt bags or through filter boxes filled with sawdust, and are thus freed from mechanical impurities. It is found that 100 parts of waste liquor give an average of 12 parts of dry residue on evaporation, which contains 9·5 parts of organic and 2·5 parts of mineral matter.

This filtrate, which contains chiefly lime salts, besides the organic matters, is mixed with more than sufficient sulphuric acid to combine with the lime under constant stirring in wooden tubs or vats provided with steam pipes, so that the gypsum can separate out. The warming and stirring are continued until all free and combined sulphurous acid is expelled, which may be condensed and utilized if desired. The completion of this part of the process can be easily found by the well-known iodate of starch reaction, and at the same time all lime contained in the liquor sinks to the bottom as sulphate. If any excess of sulphuric acid has been added, it is removed by carefully neutralizing with either quicklime or else chalk.

The clear liquor above the sediment is removed either by being carefully drawn off as it clears quickly or by the use of filter presses. If no attention is to be paid to the recovery of the sulphurous acid, and the only question is to quickly purify the waste liquor, then a suitable quantity of lime is added to the filtered liquid, so that the lime added to that contained in the waste liquor is deposited as insoluble monosulphite of calcium. Warming is an advantage for quick separation.

The purified liquors are concentrated to about 40° B. in special evaporators constructed for the purpose, and the evaporation is sometimes even carried to dryness. While still warm the mass is mixed with double its weight of a mixture of 2 parts of caustic or quick lime and 1 part of caustic soda, or, if required, with an equivalent quantity of alkalies.

The next process is the heating of the mixture, with constant stirring, and avoiding any carbonization, in iron vessels, to a temperature of above 180° C. The product so obtained is treated in the usual way for the preparation of pure oxalic acid or of compounds of the same acid.

Another method consists in concentrating the purified liquors to about 30° B., and mixing this sirup to a thick and uniform consistency with sawdust, ground shavings or bark or other organic matter. After this is mixed with a due proportion of caustic alkali, it is treated in the manner described above.

The inventor of these processes is Dr. A. S. Nettle, of Prague, Bohemia, who claims that in many cases a yield is obtained by these methods far superior to that produced by hitherto known processes.—*Paper Trade Journal.*

Professor Liebreich's Remedy for Tuberculosis.

We have received by telegram from our Berlin correspondent an account of the remedy which Professor Liebreich has introduced as a means of combating tubercular disease, and the good effects of which were vouched for by Professor B. Fraenkel in his speech at the Berlin Medical Society on February 18. It was at the meeting of this society on the 25th that Professor Liebreich gave an account of his remedy, which consists of cantharidate of potash, a combination of 0·2 grm. pure cantharidin and 0·4 grm. of potassic hydrate in 20 cubic centimeters of water. In his opening remarks Professor Liebreich regretted that the older methods of treating disease had been so much lost sight of, and he said that he had been led to think of cantharidin in the present connection by the good effects observed from the prescription of cantharides in skin diseases. The specific property of cantharidin is to excite serous exudation from capillary vessels, and he argued that this effect would more readily occur if those vessels were already irritated. In applying the drug to cases of tuberculosis he proceeded very cautiously, commencing with injections of 1·50 of a decimilligramme of the solution of the cantharidate of potash, and gradually increasing the dose. It was found that the expectoration was thereby increased, and that the ordinary dose required to produce substantial effect was one to two decimilligrammes. It is likely that six decimilligrammes would be the maximum amount that could be safely used. No cures have yet been effected, but, as already said, Professor B. Fraenkel and Dr. Heymann have been struck with the remarkable amelioration of cases so treated, and with the absence of any untoward symptoms. The drug probably only affects the diseased tissues, and it may be applicable to other affections than tubercle. The address was followed by great applause.—*Lancet.*

Cholera and Snake Bite.

It is a somewhat remarkable circumstance that while the advanced physicians of Europe are seeking remedies for certain of the most dire diseases, in the attenuated virus of such diseases, or in the blood of animals immune to them, the same principle is advocated in India for the cure of snake bite and cholera. We have received, says the *Chemist and Druggist*, from Mr. Dinshah Ardeshir, municipal commissioner to the Maharajah of Baroda, a copy of "A Note on the Probable Discovery of Snake Bite and Cholera Cure." Mr. Ardeshir informs us that a certain tribe of serpents yield in their skull a semi-transparent, yellowish substance, which is called the serpent's *mohara*, and the application of which to a snake bite prevents any evil consequences. But it is not this which Mr. Ardeshir would investigate, nor the roots and other antidotes which have been brought under his notice. The remarkable fact that the common weasel attacks serpents, whose bites have no fatal effect upon it, has led him to the "belief that the blood of the weasel must in itself be an antidote for snake poison." Accordingly, he proposes to inoculate various animals, which have been bitten by a venomous serpent, with the blood serum of a weasel. This proposal conforms exactly with the line of the diphtheria research which has recently been completed. As "an alternative process" Mr. Ardeshir also proposes to "attenuate" the serpent virus, if we may use the expression in this case, by inoculating the blood of animals with serpent virus, "and then constituting an extract for inoculation into the blood of a human being bit by a serpent," provided the method is first shown to be successful on the lower animals. This looks like sound science according to Koch and his disciples. Koch's failure with cholera does not intimidate Mr. Ardeshir, whose opinion is that the reason why we have not "an infallible cure for cholera is our failure in getting at the root of this fell disease."

The Milk of the Egyptian Buffalo.

According to the researches of Messrs. Rappel and Richmond, of the Khedival Laboratory, Cairo, the milk of the Egyptian buffalo, or gamoose (*Bos bubalus*), presents several characteristics distinguishing it from that of the cow, which may well be remembered by medical men who have to treat patients, especially infants, in Egypt or in other countries where this animal is common. The amount of fat, as we learn from the *Lancet* of August 23, 1890, was found to be a good deal larger than in cow's milk, the percentage in the specimens examined varying from 5·15 to 7·35. The sugar, which appeared to be a hitherto undescribed variety, differing from milk sugar, was also found to be of larger amount than that in cow's milk, the average percentage being 5·41. It is suggested that this sugar should be called *tewfikose*. The fat, too, was found to differ from that of cow's milk, containing minute quantities of sulphur and phosphorus, and yielding four times as much caproic acid as butyric acid, whereas in cow's milk the quantity of caproic acid is only double that of butyric acid. The milk also contained citric acid.

THE reduction in the price of commercially pure aluminum from $2 per pound to $1 has been announced by the Pittsburg Reduction Company. The price of the metal below 97 per cent and above 90 per cent pure, containing neither sulphur nor phosphorus, which is suitable for alloying with iron and steel, has been further reduced to 90 cents per pound.

Early History of Steam Navigation.

At a recent meeting of the American Society of Mechanical Engineers a chronological statement was read by William Kent of the several experiments in propulsion by steam which were made before Fulton's time, with lantern views illustrating many of them.

The following is an abstract of Mr. Kent's chronological lecture on steamboat experiments down to the time of Fulton. In it he gives due credit to all claimants of the honor of being the first inventor of the steamboat, arranging them in order of their dates.

1543.—Spanish writers tell a somewhat apocryphal story of a boat of 200 tons moved by paddle wheels, built by Blasco de Garay. Part of the machinery was said to be a vessel of boiling water. Objection was made to this part of it on account of the danger of explosion. No credence can be given to this story, as far as it has any reference to steam power.

1621.—Witsen's treatise on shipbuilding, published at Amsterdam in 1621, has an engraving of what is called a Liburnian or Leghorn vessel propelled by paddle wheels turned by oxen. A reproduction of this engraving is given in vol. xix. of the *Mechanic's Magazine*.

1651.—An English pamphlet, supposed to be by the Marquis of Worcester, contains an indefinite reference to what may have been a steam engine, and it was said to be capable of propelling boats.

1690.—*Denys Papin* proposed to use his piston engine to drive paddle wheels to propel vessels.

1707.—Papin applied his pumping engine to raise water to turn a water wheel, which in turn drove the paddle wheels of a boat. He drove a model boat in this way on the Fulda at Cassel. This was probably the first actual experiment in driving a boat by steam power.

1736.—*Jonathan Hulls* took out an English patent for the use of a steam engine for propelling ships. There is no record of it having been carried into effect.

1752.—*Bernouilli* obtained a prize from the French Academy of Science for the best essay on the manner of propelling vessels without wind. He proposed a set of vanes like those of a windmill (a screw propeller in fact) driven by either animal or steam power. He also proposed jet propulsion, or the driving of a vessel by the reaction of a jet forced out of her stern. About the same time Gautier proposed to use the Newcomen engine to drive paddle wheels.

1760.—*Genevois*, a Swiss, proposed to compress springs by steam or other power, and apply their efforts to propel vessels.

1763.—*William Henry*, of Lancaster, Pa., went to England in 1760, and there became acquainted with Watt's engine, which was then new. He returned to America, and in 1763 built an engine and put it in a boat fitted with paddle wheels on the Conestoga River. The boat sank on her trial. He built another, but nothing seems to have come of it. In 1783 he said to a German traveler: "I am doubtful whether such a machine will find favor with the public, as every one considers it impracticable against wind and tide." In 1777 Robert Fulton, then twelve years old, visited Henry to study the paintings of Benjamin West, who had long been a friend and protege of Henry, and there he probably got his first ideas of steam navigation.

1770.—*D'Auxiron*, in France, prepared plans for adapting Watt's engine to propulsion, and in 1772 was granted the monopoly of the use of steam in river navigation in France for fifteen years, provided he should prove his plans practicable.

1774.—D'Auxiron and his friends, Mounin and Jouffroy, built a boat which, when near completion, sank at its wharf. D'Auxiron died before the boat was recovered and completed. After his death his monopoly was turned over to Jouffroy, who consulted Perier, a distinguished mechanic. The latter built the boat on new plans, and it was tried in the Seine, but failed to develop speed, and Perier abandoned it.

1776.—*Jouffroy* built a boat 14 feet long, 6 feet wide, with a Watt engine and a chain carrying duck-foot paddles. The paddles proved unsatisfactory and he adopted a paddle wheel, driven by a ratchet wheel motion by the piston rod of the engine.

1783.—This boat of Jouffroy's was tried in public at Lyons, July 15, 1783, and is said to have been successful, but the French government declined to confirm to Jouffroy the monopoly on the ground that the experiment was not made at Paris. Jouffroy became discouraged and abandoned further attempts.

1774.—*James Rumsey*, of Virginia, began experiments in steam navigation.

1786.—Rumsey succeeded in driving a boat four miles an hour in the Potomac, Shepherdstown, W. Va., in presence of General Washington. He used the system of jet propulsion which had been proposed about thirty years before by Bernouilli.

1787.—Rumsey obtained a patent for the State of Virginia. He wrote a treatise on the application of steam, and organized a Rumsey Society at Philadelphia for the encouragement of steam navigation. He died in London in 1793 while explaining his scheme to a London society. A boat of his was tried in the Thames in 1793 and made four miles an hour.

1785.—*John Fitch*, who was born at Windsor, Conn., in 1743, and died at Bardstown, Ky., in 1798, in April, 1785, conceived the idea of applying steam to locomotion on land, and a few days afterward was led to consider plans for applying steam to propulsion of vessels. In August he showed a model of his boat to Dr. Ewing, of the University of Pennsylvania, and in September presented a model to the American Philosophical Society at Philadelphia.

1786.—Fitch made experiments on a skiff, with a three-inch engine, driving paddles; he besieged Congress and the Legislature of Pennsylvania for funds, but was unsuccessful. In the same year he was granted a patent for fourteen years by the State of New Jersey.

1787.—Fitch raised $800, and in February began a boat of 60 tons, 45 feet long by 12 feet beam, with six oars or paddles on each side. The engine had a 12-inch cylinder. In May, 1787, a trial trip revealed some defects, which were corrected, and on August 27 of the same year a successful trial trip was made at Philadelphia. Patents were obtained in Pennsylvania, New York, and Maryland. About the same time Fitch had a controversy with Rumsey concerning priority of the invention.

1788–1790.—Fitch built larger boats, which ran regularly in 1790 between Philadelphia and Burlington, making as high as seven miles an hour.

1791.—Fitch received a United States patent August 26.

1793.—Fitch went to France. The "Cyclopedia of Biography" says that he deposited his plans with the American consul at L'Orient, while he went to London. The consul showed his plans to Fulton, who was then in France, in whose hands they remained several months. Failing to get the privilege of building his boats in France, he returned to America in 1794.

1796.—Fitch experimented on a ship's yawl, fitted with a screw, in the Collect Pond, N. Y.

1798.—Fitch made a three-foot model boat at Bardstown, Ky. He committed suicide the same year.

1787.—*Patrick Miller*, of Dalswinton, Scotland, experimented with paddle wheels.

1787.—*James Taylor* suggested the employment of steam instead of manual labor. This is denied, however, by the son-in-law of Symington in a letter to *Mechanic's Magazine*, vol. xxviii., 1838, claiming the invention for Symington.

1787–1788.—*William Symington* was employed by Miller to construct an engine for a new boat with two cylinders four inches in diameter. It was tried October 14, 1788, and made five miles an hour.

1789.—Symington built another boat for Miller December, 1789; it made seven miles an hour. Miller then dropped the matter. He condemned Symington's engine as being "the most improper of all steam engines for giving motion to a vessel."

1801.—Symington's third boat, the Charlotte Dundas, built under patronage of Lord Dundas, was tried in 1802. Mr. Symington's son-in-law says (*Mechanic's Magazine*, vol. xix.) that in July, 1801 or 1802, Fulton visited Symington and made a trip on his vessel on the Forth and Clyde Canal, and obtained his designs and ideas. This statement is shown to be untrue by letters of Fulton now in existence, which prove that Fulton never was out of France during either of these years.

1802.—Symington's Charlotte Dundas, in March, 1802, towed two 70 ton vessels in the Forth and Clyde Canal, but the proprietors of the canal disapproved of them, fearing injury to the banks. The Duke of Bridgewater gave Symington orders for eight boats for his canal, but died shortly afterward, and the completion of the contract was thus prevented. Symington became discouraged and gave up in despair.

1811.—*Henry Bell*, of Glasgow, who had seen the Charlotte Dundas, built the first passenger vessel in Europe. He was a loser by his venture, but the boat was a success. In 1815 he built several other boats, and his success was then complete. Symington beginning his experiments in the winter of 1787–1788, and trying his first boat October 14th, 1788, is clearly anticipated by John Fitch in America, who made his first experiment with a paddle-wheel boat driven by a steam engine in 1786, and his first public trial on August 22, 1787. The *Mechanic's Magazine*. vol. xxviii., 1838, p. 25, credits Fitch with being an independent but second inventor, claiming Symington as the first; but it erroneously states that Fitch did not begin his operations until 1788. Between the time of Symington's second boat, 1789, and his third, 1801, much was done in America.

1792.—*Elijah Ormsby* built a small steamer at Narragansett Bay, using an atmospheric engine and duck-foot paddles. It made three or four miles an hour.

1798.—*Nicholas Roosevelt* is said to have built the Polacca, a vessel 60 feet long, with a 20-inch engine having a 2-foot stroke, which drove it eight miles an hour. Livingston and Stevens had induced Roosevelt to try their plans still earlier, they paying the expense of the experiments. Livingston used jet propulsion, and Stevens a screw.

1798.—The State of New York gave *Livingston* the right to steam waters in the State for 20 years, if he should succeed, within 12 months, in producing a boat that should go four miles an hour.

1803.—Livingston procured the re-enactment of the law in favor of himself and Robert Fulton, who was then experimenting in France.

1791—*John Stevens* experimented on steamboats. In 1789 he had petitioned the New York Legislature for a grant similar to that made to Livingston, and he stated that his plans were then completed and on paper.

1804.—While Fulton was in Europe, Stevens completed a steamboat 68 feet long and 14 feet beam. This was a twin-screw boat. Its machinery is preserved in the Stevens Institute of Technology, Hoboken, N. J. In May, John Stevens and R. L. Stevens crossed the Hudson River in this boat.

1807.—John Stevens and his sons built a paddle-wheel boat, the Phœnix, which made its trial just too late to anticipate Fulton's successful trial with the Clermont.

1808.—The Phœnix went to Philadelphia by sea, being the first steamboat to make a sea voyage.

1804.—*Oliver Evans* built a combined wagon and steamboat called the "Oruktor Amphibolis." It was a flat scow with a five horse power engine. He propelled it up Market Street, Philadelphia, launched it in the Schuylkill, and sailed down to the Delaware. This was the first application of steam to carriage on land in America. Evans was the inventor of the high pressure engine, copied later by Vivian, Trevethick and others. He died, "poor, neglected, and broken hearted."

1789.—*Nathan Reid* built a paddle wheel boat turned by a hand crank. He designed a steam boiler, the first vertical tubular boiler, in 1788, intending it to be used in steamboats. He does not appear to have made any successful experiments in steam navigation.

1790.—*Samuel Morey*, Oxford, N. H., built a paddle-wheel steamboat and tried it successfully on the Connecticut River.

1791.—*Rumsey*, Fitch, Stevens, and Morey all obtained patents in 1791 for various methods of propelling vessels by steam power.

1793.—Morey made a trip from New York to Hartford. He built a larger boat at Bordentown, N. J., in 1797 and made a trip to Philadelphia. His funds gave out and he gave up his project. Fulton, Livingston, and Stevens met Morey in New York, but nothing definite is known of the dimensions of his boats or machinery.

1793.—*Robert Fulton* (born at Little Britain, Lancaster County, Pa., 1765, died at New York, 1815) proposed plans for steam vessels, both to the United States and the British governments. In 1779, when only 14 years of age, he experimented with paddle wheels turned by hand on the Conestoga River. In 1802, while in France, he made drawings and a model of a side-wheel steamboat. In 1803 he had a boat built by MM. Molar, Bordel, and Montgolfier, on the Seine, and it made 4½ miles an hour on its trial, August 9. The water tube boiler of this boat, known as Barlow's boiler, is still preserved in the Conservatoire des Arts et Metiers, in Paris. In 1804 Fulton ordered from Boulton & Watt an engine from his own plans, 2 feet in diameter and 4 foot stroke. This engine was completed in 1806, and shipped to the United States, Fulton having preceded it. He immediately contracted for a hull in which to set it up.

1807.—In 1807 the engine was fitted to the Clermont, the hull of which was 133 feet long, 18 feet wide, and 9 feet deep, a far larger steam vessel than any hitherto constructed. In August, 1807, it made a successful trip to Albany, 150 miles, in 32 hours, returning in 30 hours. Its success was such that it soon afterward ran as a regular passenger vessel between New York and Albany, and the era of steam navigation was at last begun. In 1808 two new steam vessels, the Car of Neptune and the Paragon, each of which was nearly double the size of the Clermont, were built by Fulton.

The Spanish story of 1543 has been settled by Mr. Botsford, who has shown that it had been investigated in Madrid in 1858, and that it was then proved that Blasco de Garay's boat had been moved by men secreted in the hull. He has also disposed of Symington's claim by showing that if an unsuccessful experimenter, who abandoned his work in despair, is entitled to be ranked with Fulton, then Symington must give place to John Fitch, who both antedated him and more nearly reached success. But the higher honors must be given to Fulton, as the inventor, the engineer, and the successful business man by whose labors steam navigation became an accomplished fact.

IN connection with the equipment, for fire protection, of woodworking establishments, *Fire and Water* recommends placing a gallon pail filled with fine sand within convenient reach of each workman employed where oiling and finishing. This practice might well be followed wherever there is a possibility of fire starting in oil or oil-soaked materials. There is nothing which will squelch an oil-fed fire in its incipiency more quickly and effectually than sand; and there are no afterclaps in the way of water damage, either.

Type-Setting Machines—Important Patent Decision.

In the United States Circuit Court, New York, on March 11, Judge E. Henry Lacombe granted a preliminary injunction against the New York Typograph Company and others, representing the Rogers patented type-setting machines, and in favor of the National Typographic Company and others, representing the Mergenthaler system. Strictly speaking, neither of the machines sets type, but type matrices are arranged, by the fingering of a keyboard in proper order and position for the casting of a line of type, and the latter operation is automatically performed, so that bars or slugs, representing a line of type each, are the product of the machine. It can be readily run by an expert operator at a speed of four to five thousand ems per hour, equal to more than a column of the SCIENTIFIC AMERICAN. The Mergenthaler machine was fully described and illustrated in the SCIENTIFIC AMERICAN of March 9, 1889, and August 9, 1890. Almost the entire work of the New York *Tribune* has been done on this machine for more than six years past, and other daily papers in different cities are using it, to the exclusion of type-setting in the ordinary way.

In the Rogers machine the solid printing bar is cast, but the mechanism by which it is accomplished differs in many respects from Mergenthaler's. Judge Lacombe in his decision holds :

That the machines manufactured and sold by the defendants may be lighter, smaller, cheaper, more easily operated, and more efficient; that they may be a decided improvement on the Mergenthaler machine, and may as such commend themselves more readily to the public; that they are themselves patented, and that, if put in open competition with the earlier machines, they would prove more attractive to purchasers and users—each of which points is pressed with great force by the defendants—is wholly immaterial if the complainants' main contention is a sound one, viz., that the Mergenthaler "linotype" is covered by a foundation patent; that it embodies a combination wholly new in the printing art, which marks the first great step in advance taken for over 400 years, and which, though susceptible, as all new foundation patents are, of subsequent improvement, has yet demonstrated its ability, practically and efficiently, to perform the work which it was designed to do. If, upon the case now presented, it appears that Mergenthaler is a pioneer inventor, he is to be secured the fruits of what he invented and covered by his patent, even as against a subsequent inventor, who, though he may have greatly improved it, still uses the original invention which lies at the foundation of the art. (See cases cited in notes to Section 894, Robinson on Patents.)

The product of the combination of machinery described in the patent and thus claimed is a line of type, cast in a solid bar, presenting on its printing edge any combination of letters and printer's marks which the operator may desire—produced automatically. By its use a great change is introduced in the printer's art, whereby the type-setting of single types is dispensed with, and the matter is set up from "slugs," or "bars," each containing, not a single letter, nor a single word, but any conceivable combination of words and figures. That such a change in the art is almost revolutionary seems to be practically conceded, the defendants insisting, however, that the merit of the invention which effected it must be shared so largely with others, earlier in the field, that Mergenthaler can at most claim but an extremely small part of it for himself. Upon the papers, however, it appears that Mergenthaler was the first man who united in a single machine the instrumentalities which, by means of the operation of finger keys, assembled, from magazines or holders, independent disconnected matrices, each bearing a single character, carried each individual character independently one by one to a common composing point, where they were placed in line, and were thereupon brought in contact with and closed the face of a mould, of the exact length of a predetermined line, into which mould, by the subsequent operation of the same machine, molten metal was injected and a cast taken, which cast consists of a line bar of type metal, having on its printing edge any desired combination of characters, and which is ready as it leaves the machine for imposition on the form. Some such combination was required to solve a problem with which inventors in the field of the printer's art had struggled for years, and there is not found in any of the earlier patents and methods which have been put in evidence by the defendants anything which fairly anticipates it.

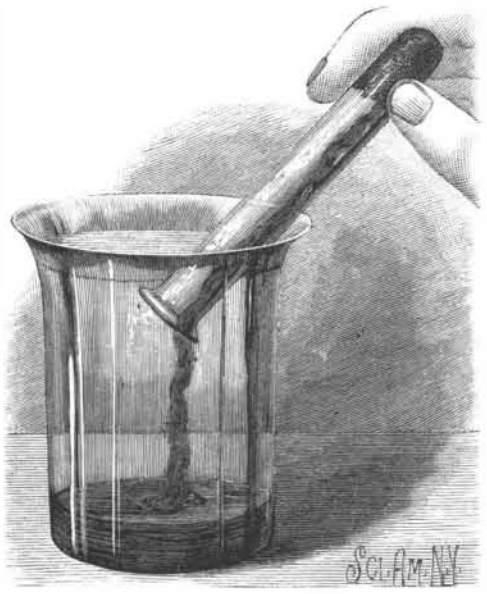
The patent which covers it may, therefore, be fairly considered a foundation patent, and its claim should be broadly construed. When thus construed, infringement seems plain. Though there are differences in the form and structure of the intermediate mechanism, tending to simplicity and perhaps improvement, and in the form of the casting mechanism, still each of these mechanisms as it is embodied in the defendants' machine performs the same function as the corresponding mechanism in the Mergenthaler machine, in substantially the same way, and they are combined to produce the same result. The combination which is covered by the claim is the same in both. There is sufficient here to fortify the presumption of the patent, especially as there seems so little real question about either its validity or the infringement of the claim above quoted by defendants' machine.

EXPERIMENT IN SPECIFIC GRAVITY OF FLUIDS.

T. O'CONOR SLOANE, PH.D.

The illustration shows a very interesting experiment on the law of the specific gravity of liquids, which, simple as it is, presents a very good exposition of the phenomena brought out by the operation of this law. A strong solution of potassium bichromate in hot water is made in a test tube. By boiling the water and adding the salt as long as it dissolves, an exceedingly strong solution can be produced. It is then cooled. This cooling is best effected by placing the test tube in a beaker of cold water with its mouth upward in the regular position. As it cools, the bichromate of potash rapidly crystallizes from the supersaturated solution, and the building up of these crystals is in itself an exceedingly interesting process to watch. When it has cooled, the experiment proper can be carried out.

A beaker is filled with cold water. The test tube is next filled to the brim. It is closed with the thumb, and the mouth of the test tube is immersed in the water of the beaker and then released. The object is to prevent the admission of any air whatever. As soon as this is done, the bichromate of potash in what is now the upper end of the test tube begins to dissolve. As it dissolves, it forms a solution heavier than the water, and pours in a stream down the lower side of the test tube, through the water, to the bottom of the beaker. It inevitably mixes more or less with the water surrounding the streams, but at the same time the course can be distinctly traced by holding the



EXPERIMENT IN SPECIFIC GRAVITY OF FLUIDS.

beaker against the light. At the same time a stream of clear water can be observed, rising along the upper walls of the test tube to supply the place of the heavy fluid escaping therefrom. It is easy to see that carried out with the proper tank and a small test tube, this experiment would form an admirable illustration for projection by the magic lantern.

The same experiment has its useful application. The principle is used in the laboratory for dissolving the melted mass from sodium carbonate fusions, as in the analysis of iron ores, etc. For cleaning out battery jars, in which very hard crystals of chrome alum often form, or for dissolving the same crystals in bottles in which battery solutions which are partially exhausted have been kept, the same method is applicable. By a little manipulation the battery jar or bottle can be inverted in a bucket of water, itself being full. It is well to support it on a couple of bricks, or by other means, as far above the bottom of the bucket as possible, in order to admit of the free escape of the strong solution thus formed. An inclined position, as favoring the regular ascent and descent of the two columns of liquid, is also to be recommended where the process is practically applied. Crystals quite irremovable by ordinary means can thus be dissolved, and the bottle or jar saved. Sometimes several hours are required, and it is also well to renew the water in the bucket or other receptacle. Care must be taken to admit no air.

Canal Enterprises.

Up to December last over $45,000,000 had been expended on the Manchester ship canal, to provide an adequate waterway to the ocean from this great manufacturing center of the north of England. It is now found that about $20,000,000 more will be required to complete the work, which is a good deal larger sum than the canal company can command, and the city of Manchester has been asked to extend its credit to the enprise to the amount of $15,000,000, the outside public having failed to subscribe for debentures to form a first charge on the property. The work has been somewhat interfered with during the winter, but is now being energetically pushed forward at many points. A committee of the Manchester corporation has advised the giving of the required assistance to the enterprise.

The constructors of the ship canal across the Isthmus of Corinth appear to have met with unexpected difficulties. This company was reorganized in 1889, and great preparations were then made for pushing the work, workshops being erected along the line and an adequate plant provided. It is now stated, however, that sufficient slope was not given to the argillaceous banks, and that it has been necessary to protect large sections with solid masonry. The section to be cut being frequently as much as 250 feet vertically, it is now apparent that the amount of earth to be removed will be enormously in excess of what had been contemplated, or the canal will have to be protected throughout its whole length with solid masonry—in either case greatly increasing the cost.

Although it would seem that the Panama Canal is now quite dead, there yet appear to be people in France who entertain hope of a revival of the project in some form. One scheme to this end is that of M. Amedée Lebillot, who proposes to connect the two unfinished portions of the canal by means of a ship railway, the work to be completed in three years at a cost of $50,000,000. The locomotive it is proposed to use on this railway is in the form of a ship's cradle having propelling mechanism in the interior, the cradle to be sunk under the vessel, draw it out of water, make the journey overland in two hours, and as promptly float the ship in the other section of the canal.

In spite of the disaster that has overtaken the work at Panama, there is every reason to feel encouraged by the progress that has been made at Nicaragua. The latter route was equally open to the French engineers, and it is safe to say that, with half of the money which has been irretrievably sunk at Panama, they might by this time have had in successful operation a practical ship canal for the largest vessels through Lake Nicaragua to the Pacific Ocean. Ex-Senator Warner Miller, President of the Nicaragua Canal Construction Co., with several engineers and other assistants, sailed from New York for Nicaragua on March 14. Only about four million dollars have now been expended upon the work, but very substantial results are apparent in the opening of a safe harbor at Greytown, the clearing away of the route and the construction of a railway on the line to the principal "divide," with the erection of workshops and the providing of all necessary facilities for an energetic attack upon the main difficulties of the undertaking.

The engineers estimate the cost of the whole work at $65,000,000, but Mr. Miller places it at about $100,000,000, with interest accruing during construction. The projectors hope, as do the Foreign Affairs Committee of the United States Senate, that the government will become interested to the extent of guaranteeing the bonds of the company at a low rate of interest, thus keeping the control of the canal in American hands, but they have no distrust of their own ability to provide all the funds necessary, and are not delaying the construction to wait for government assistance. Mr. Miller has a high reputation as a capable and successful business man, and he has entered upon this enterprise as a practical project, to be worked out by dollars and cents, in the full confidence that the investment will be a good paying one to all who put money in it, as well as of high importance in the development of American commerce.

Among other important canal projects, one which of late attracted considerable local attention is the plan for a water connection of Pittsburg with Lake Erie. The route has been several times surveyed, but the exact course which would be most practical has not yet been fully determined. The matter was recently reported upon by a Pennsylvania State commission, and the cost of such a canal was put at $27,000,000. Pittsburg is now using such large quantities of Lake Superior ores that the railroad freights have become a large item in her iron and steel manufactures, and the competition of Southern iron producers has become so sharp that every possible economy must be studied or Pittsburg will be in danger of losing her established prestige in this branch of industry. It is figured that the construction of this canal would reduce the cost of transporting ore to Pittsburg from Lake Superior by about two dollars a ton.

HIGH PLACES.—The highest place in the world regularly inhabited is stated to be the Buddhist monastery Halne, in Thibet, which is about 16,000 feet above sea level. The next highest is Galera, a railway station in Peru, which is located at a height of 15,635 feet. Near it, at the same level, a railway tunnel 3,847 feet in length is being driven through the mountains. The elevation of the city of Potosi, in Bolivia, is 13,330 feet; Cuzco, Peru, 11,380 feet; La Paz, Bolivia, 10,883 feet; and Leadville, Colo., 10,200 feet.